



Science Committee Report

Dr. Wes Huntress, Chair

Science Committee Members

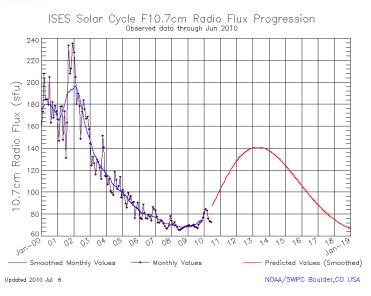
Wes Huntress, Chair
Byron Tapley, (Vice Chair) University of Texas-Austin, Chair of Earth Science
Alan Boss, Carnegie Institution, Chair of Astrophysics
Ron Greeley, Arizona State University, Chair of Planetary Science
Gene Levy, Rice University, Chair of Planetary Protection
Roy Torbert, University of New Hampshire, Chair of Heliophysics
Jack Burns, University of Colorado
Noel Hinners, Independent Consultant
*Judith Lean, Naval Research Laboratory
Michael Turner, University of Chicago
Charlie Kennel, Chair of Space Studies Board (ex officio member)

^{* =} resigned July 16, 2010

Agenda

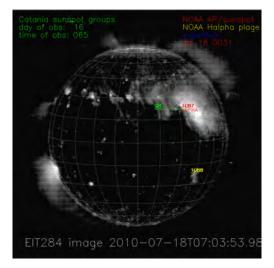
- Science Results
- Programmatic Status
- Findings & Recommendations

Unusual Thermosphere Collapse





- Deep drop in Thermospheric (50 400 km) density
- Deeper than expected from solar cycle & CO2

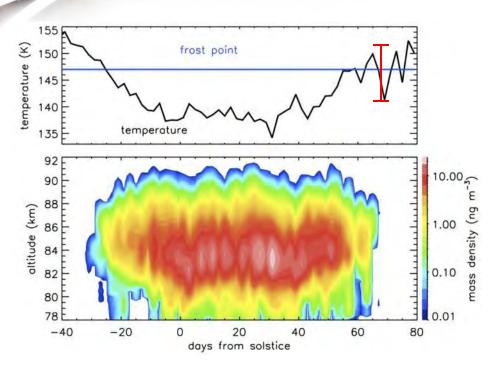


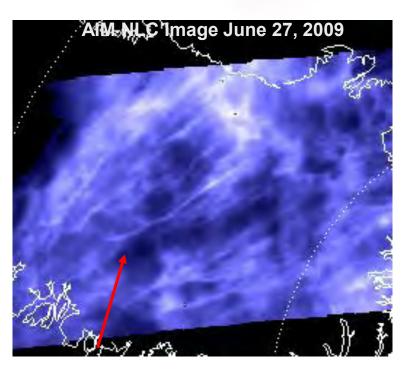


Aeronomy of Ice in the Mesosphere (AIM) unlocking the secrets of Noctilucent Clouds (NLCs)



Form 50 miles above surface in polar summer vs ~ 6 miles for "normal" clouds. NLCs getting brighter; occurring more often. Why? Linked to global change?





- AIM measured the relationship between cloud properties and temperature
- Quantified for the first time, the dramatic response to small changes, 10 deg C, in temperature
- T sensitivity critical for study of global change effects on mesosphere

Response to Gulf Oil Spill

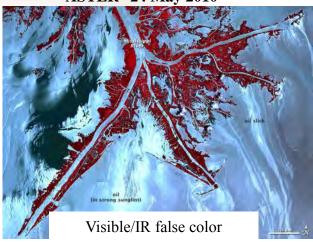
UAVSAR 23 June 2010



MODIS 31 May 2010



ASTER 24 May 2010



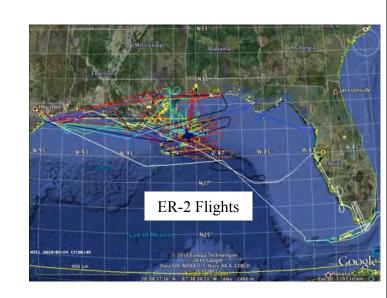
Satellite instruments: continually monitoring the extent of the spill

- •Terra & Aqua / MODIS visible and infrared daily synoptic
- •Terra / ASTER visible, near IR and thermal IR high res
- •Terra / MISR visible
- •EO-1 / Advanced Land Imager and Hyperion highest res
- •CALIPSO / CALIOP

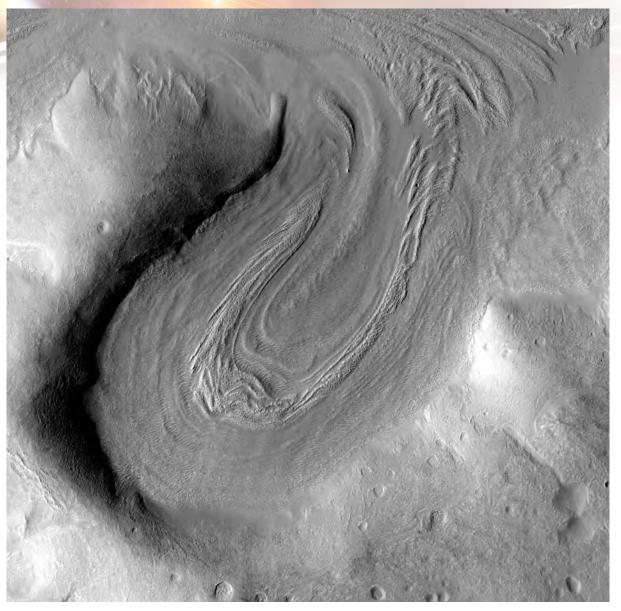
Airborne instruments: measuring surface extent and volume

- •ER2 / AVIRIS and DCS-6, 10, 11, 13, 17-20, 23-25 May
- •Twin Otter / AVIRIS (July 1-12)
- •B200 / HSRL-10-11 May; two FOO; CALIOP studies
- •UAVSAR-22-24 June

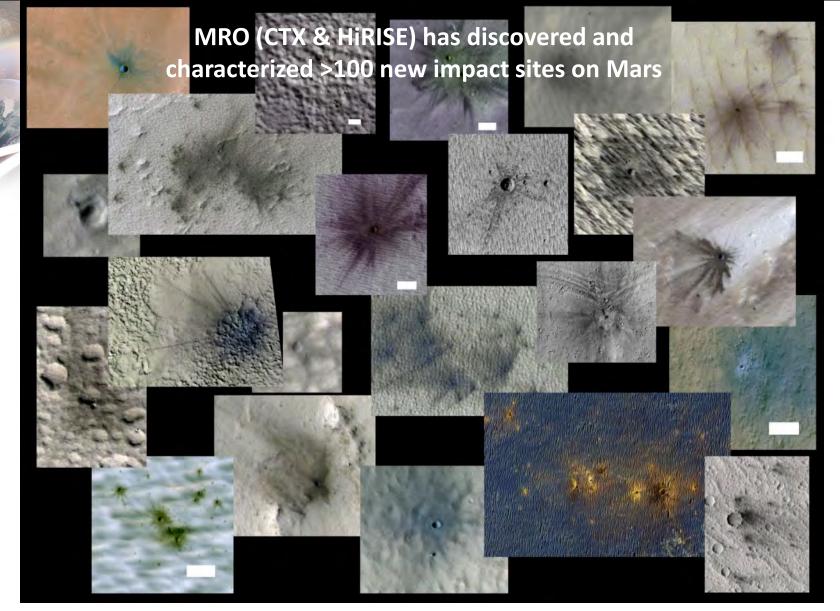
Data provided to USGS for use by first responders NOAA using radiances to initialize trajectory model; USGS for oil concentration



Glacier on Mars, 5km wide

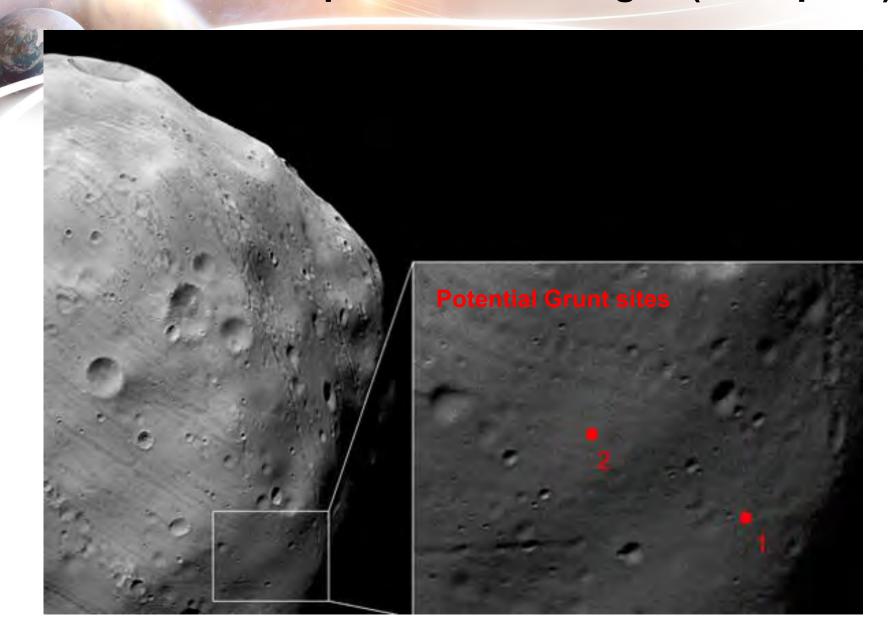


Additional evidence for water-ice at mid-latitudes (41° N)



- Patterns sensitive to bolide break-up in atmosphere and to impacted material
- Albedo markings are erased rather quickly over time (very fast in polar regions)
- All this affects measured size-frequency distributions, key to age dating, especially for geologically young terrains.

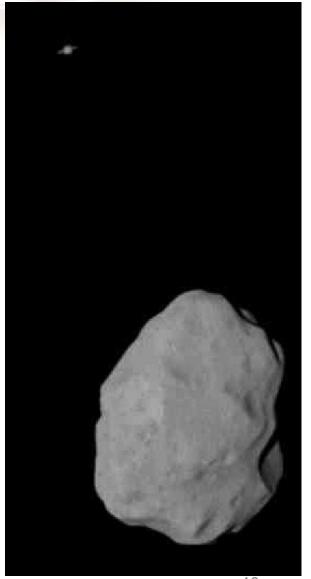
Phobos Mars Express HRSC Images (3.7m/pixel)



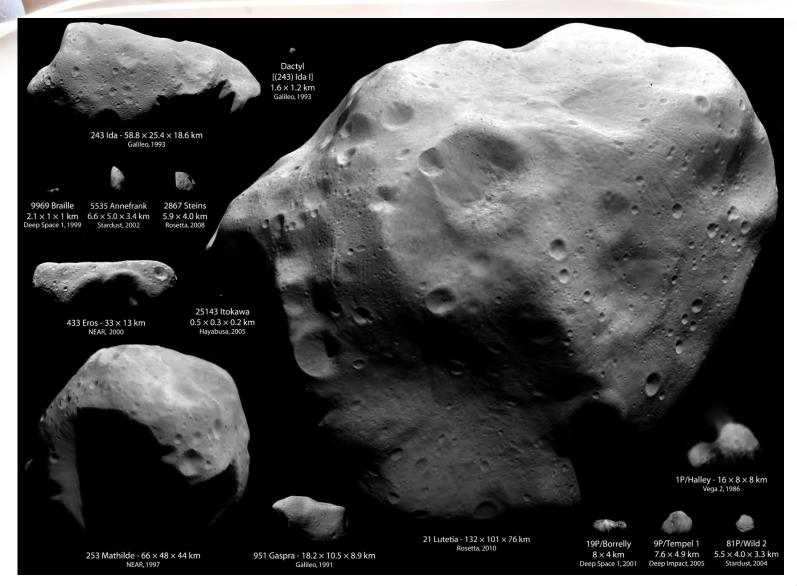
Rosetta's Encounter with Lutetia

- Main Belt asteroid (~2-2.8 AU)
- Size: 132 x 101x 76 km
- Largest asteroid observed from flyby (Matilda is ~52 km)
- Unusual type: C and M and hydrated
- May not have any meteorite analog

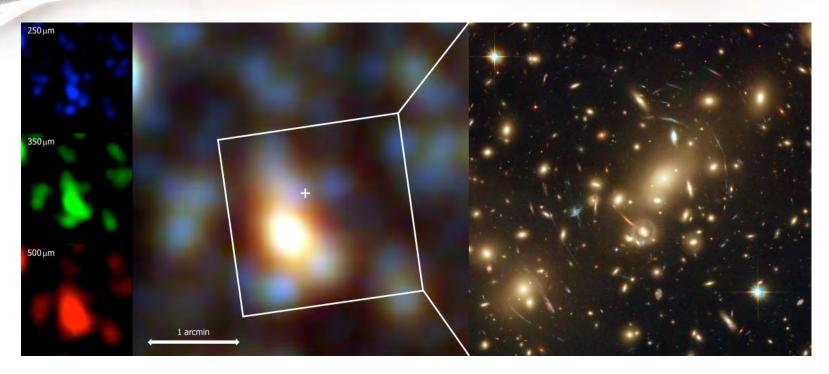




Small bodies so far encountered



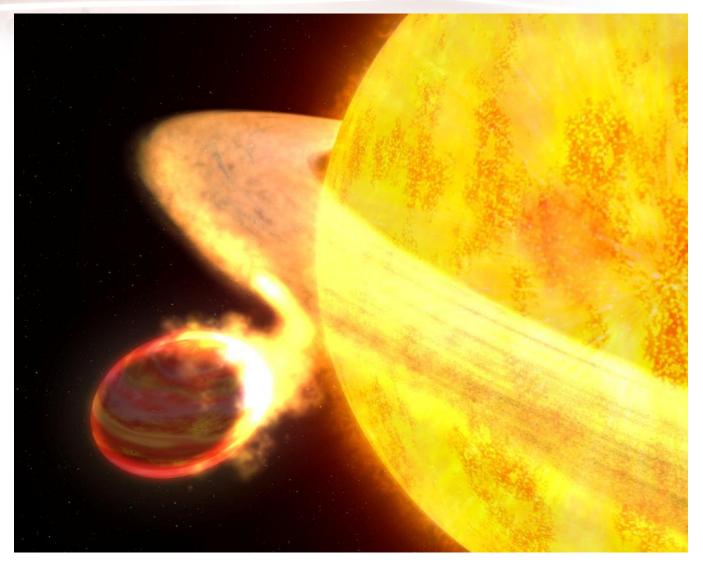
Herschel



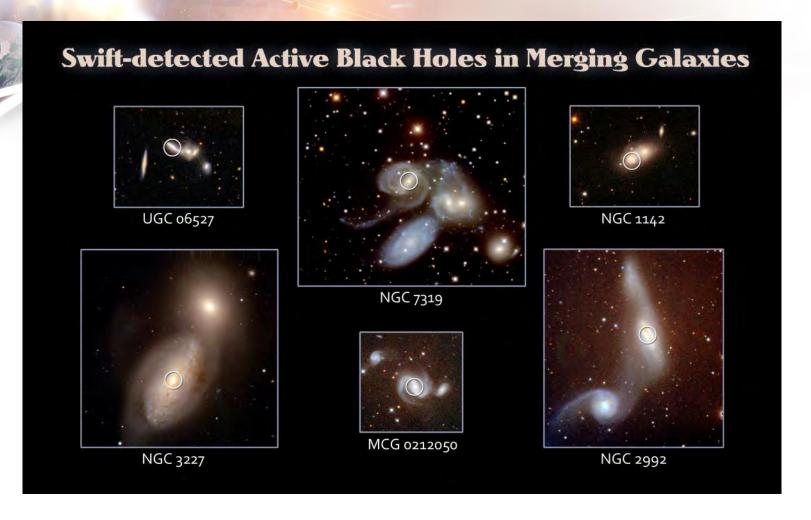
Abell 2218 cluster as seen by the SPIRE instrument on Herschel, in relation to an iconic image from the Hubble Space Telescope. The three wavelength bands are first shown as individual red, green and blue images, and then combined into a color image. The center of the cluster is marked as a white cross-hair, and the bright yellow object just below is the lensed galaxy.

Hubble Space Telescope

Hubble Finds a Star Eating a Planet.
This is an artist's concept of the exoplanet WASP-12b. It is the hottest known planet in the Milky Way galaxy, and potentially the shortest lived.



Swift



The optical counterparts of many active galactic nuclei (circled) detected by the Swift BAT Hard X-ray Survey clearly show galaxies in the process of merging. Images taken with the 2.1-meter telescope at KPNO show galaxies physically intertwined or distorted by the gravity of neighbors.

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Programmatic Accomplishments

- NRC Astro 2010 Astronomy and Astrophysics Decadal Survey report due mid-August 2010
- Earth Science Implementation Plan released June 2010
 - FY11 budget restores Earth science in FY15 to level of funding last experienced in FY00, and the level recommended by the Decadal Survey
 - Addresses Decadal Survey priorities and Administration's Climate Change Initiative
 - Increases launch cadence from ~ 0.5 /yr, to ~ 2/year
 - Plan cleared/endorsed by OSTP/OMB after interagency vetting by USGCRP

Programmatic Accomplishments

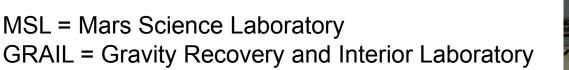
- PU-238 restart plan completed by NASA & DOE and delivered to Congress
 - Still need a passed FY11 budget in both DOE & NASA bills
- NASA-ESA's Trace Gas Orbiter (Mars 2016) instrument selection announcement on track for August
- Doug Cooke presentation to Science Committee initiates the dialogue about science participation in human exploration activities

Planetary Missions in ATLO



MSL = Mars Science Laboratory







Planetary Events Calendar

2010 November 4 Deep Impact-EPOXI flyby of Hartley 2

2010 December tbd Akatsuki arrival at Venus

2011 February 14 Stardust-NEXT flyby of Tempel 1

2011 March 18 MESSENGER orbit insertion

2011 July 21 DAWN arrival at Vesta

2011 August 11 JUNO launch

2011 September 8 GRAIL launch

2011 November 25 MSL launch

2011 November tbd Phobos/Grunt launch w/Yinghuo-1

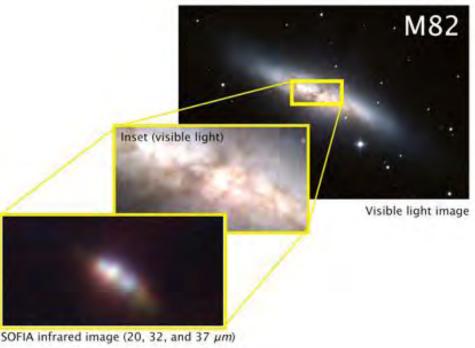
SOFIA infrared image (5.4, 24, and 37 μm) Visible light image

This composite infrared image of Jupiter was made by Cornell University's FORCAST camera during the SOFIA observatory's "first light" flight. A recent visual-wavelength picture of approximately the same side of Jupiter is shown for comparison.

Composite infrared image of the central portion of galaxy M82, from SOFIA's First Light flight, at wavelengths of 20 (blue), 32 (green) and 37 microns (red). The middle inset image shows the same portion of the galaxy at visual wavelengths. The infrared image sees past the stars and dust clouds apparent in the visible-wavelength image into the star-forming heart of the galaxy.

SOFIA first light (May 28, 2010)





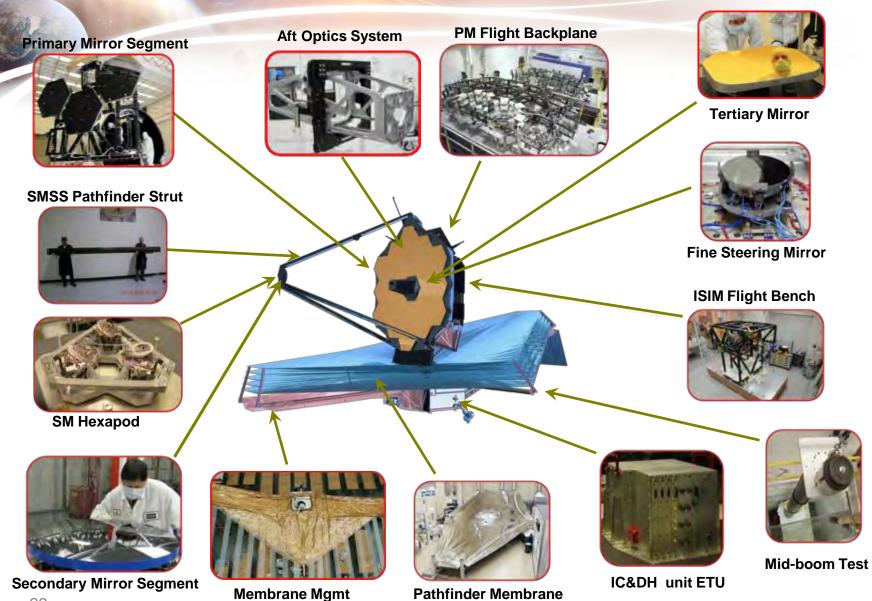
JWST Primary Mirror Fabrication and Testing

Cryo Test #4 underway at MSFC XRCF



EDU segment after coating at QCI

JWST under Construction



JWST Issues

- JWST completed its final major mission level design review conducted by its standing review board (SRB).
 - Mission Critical Design Review (MCDR) completed in April 2010
 - Post MCDR Programmatic review will continue through the summer
- Projected Northrop Grumman Aerospace cost trend alone could consume available reserves in FY11-FY12
- Integrated Science Instrument Module (ISIM) also projecting cost growth
- Additional schedule and budgetary issues have been identified
- Project is developing a plan that meets the FY11 funding guidelines

Planetary Protection Subcommittee

Two complementary, linked advisory roles... Science & Regulatory

The Regulatory Role

International agreements require that we conduct space activities so as to protect planetary environments from biological contamination, in either direction.

The Outer Space Treaty of 1967 — Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies

motivated by safety concerns and science interests

The Science Role

To preserve the ability to ascertain the natural occurrence and varieties of life requires preparation and caution, and to respond to health concerns.

- Preparation We must understand the varieties and distribution of life on our own planet.
- Caution We must guard against the inadvertent spread of life from or to the Earth.

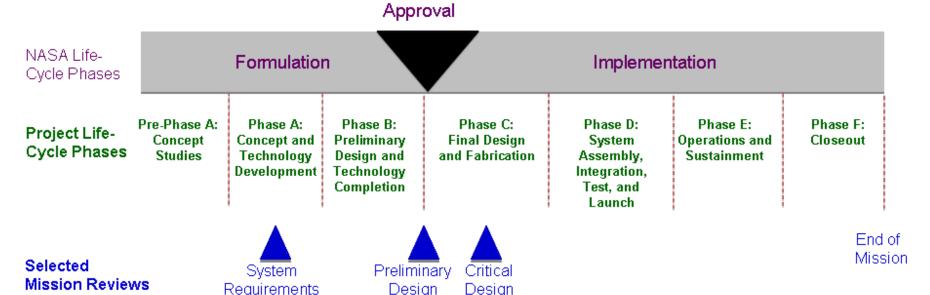
NRC Study on Cost Growth in SMD Missions

Most of the findings are quite recognizable

Review

- Many of the recommendations are already underway
- NASA moving rapidly MOWG has already met
- NAC SciCom has requested complimentary information from SMD
 - Lessons learned from missions that met their costs
 - Cost overrun data using the NRC recommended life cycle metric

NASA Mission Life Cycle



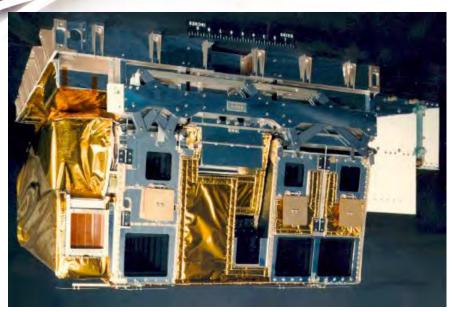
Review

Review



Prepare for the unexpected...

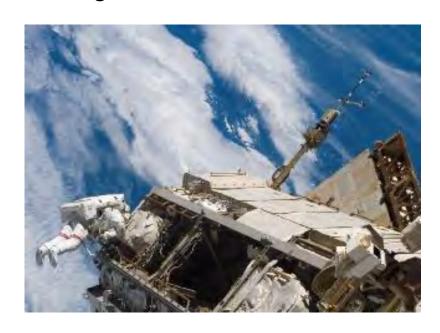
Current SMD Utilization of the ISS



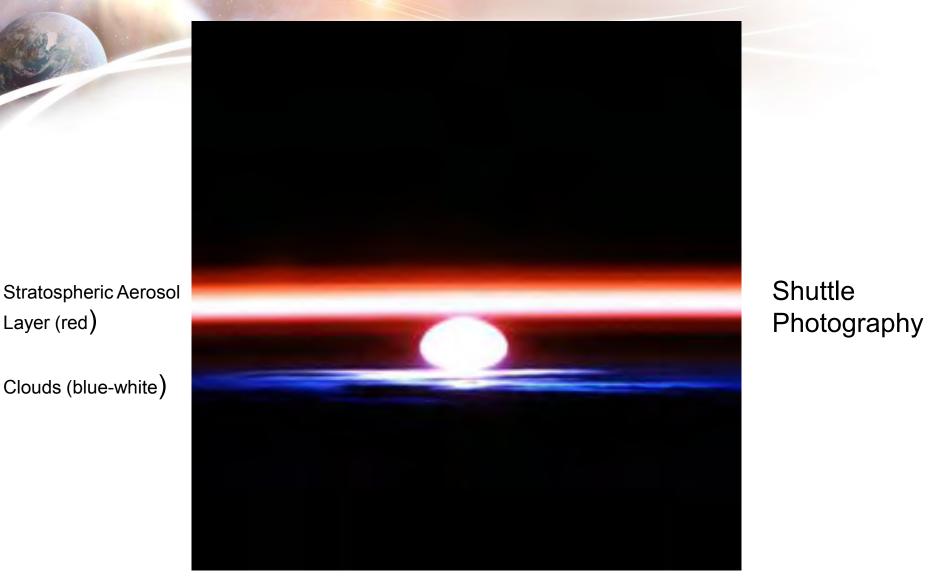
- 1 Vis Photometer 630.0 nm
- 7 Vis Photometer 765.0 nm
- 2 Vis Photometer 777.4 nm
- 3 NIR Spectrometer (700-900 nm)
- 4 NUV Spectrometer (295 -400 nm)
- 5 FUV Spectrograph (130 170 nm)
- 6 MUV Spectrometer (190 320 nm)
- 8 EUV Spectrograph (55 111 nm)

RAIDS: Remote Atmospheric and Ionospheric Detection System

Floating Potential Measurement Unit



SAGE III aerosol instrument is scheduled for the ISS



SAGE III measures the obscuration of the sun by the Earth's atmosphere from a geometry similar to that in this image. The ISS and Shuttle have similar viewing geometry.

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Future SMD Utilization of the ISS

- ISS utility for SMD limited by environmental and orbit issues but useful for niche science and for technology development
- SMD has opened mission solicitations to ISS utilization
 - AO's for PI-led missions include ISS as a platform
 - will be reviewed in competition with proposals for other platforms
 - responses will determine demand for ISS utilization in SMD
- Heliophysics has open opportunities to propose payloads to ISS:
 - Solar & Heliospheric SR&T Program call (due 3/18/2011)
 - Geospace SR&T Program call (due 6/18/2010)
- Astrophysics has provided opportunities in July 7 ROSES amendment
- Explorer AO (Helio/Astro) will solicit "missions-of-opportunity" for ISS
- Next Venture-class missions AO (Earth Sci) will do the same
- Earth Science has examined four missions for potential use of ISS
 - Problems with ISS orbit spatial and temporal coverage
 - Selected one for flight, SAGE III
- ISS utilization for Planetary Science limited to tech demos
- Science Committee opposes separate budget line(s) for space and Earth science research on ISS
 - Continue to be peer-reviewed in competition with science on other platforms

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Recommendation

Short Title: Earth Science Subcommittee (ESS) Interaction with the Joint Program Satellite System (JPSS)

Science Committee recommends that appropriate forums be established that will facilitate the development of an integrated observing space-based strategy for both research and operational National Satellite Systems.

Short Description:

Science Committee is concerned about potentially conflicting data product requirements between the operational needs of NOAA (as well as other agency partners) and the research needs of the NASA Earth Science Division.

Consequences of No Action:

The opportunity to assess the availability and quality of critical climate measurements, assumed as a foundation for the Earth Science Program described in the NRC Decadal Survey, will not be achieved.

Observation

Preserving sites on the Moon containing evidence of past human activity

Future exploration of the Moon, whether by governmental or commercial entities, is likely to result in visits to sites of past human activity such as Apollo landing sites, Surveyor and Luna landing sites, and sites of crashed spacecraft and rocket stages.

Such sites contain uniquely valuable artifacts of human presence and of the sequelae of human presence in the space environment. Unique and fragile evidence of such phenomena as "weathering" on the lunar surface, the fate of microbial matter, and the potential long-term viability of spores exposed at the lunar surface are present at these sites.

These sites should be protected from damage and their scientific integrity preserved.